Climate Change

This environmental assessment incorporates by reference (as per 40 CFR 1502.21) the Climate Change specialists report and other technical documentation used to support the analysis and conclusions of this environmental assessment. The entire report us in the project record which is located at the Sisters Ranger District office, Sisters, Oregon.

Introduction

This report discusses potential interactions between the Melvin Butte Vegetation Management Project and climate change. It focuses on predicted regional changes to temperature and precipitation patterns in central Oregon that can influence vegetation and therefore the ecosystem services forested landscapes provide.

Forests play are integral in the global carbon cycle as atmospheric carbon is fixed during photosynthesis and stored in biomass, detritus and soil organic matter. In 2011 U.S. forests and associated wood products absorb and store the equivalent of 16% of the Carbon Dioxide (CO2) emitted by fossil fuels in the U.S. each year (Joyce Et Al. 2014). Forest carbon sequestration can help mitigate climate change effects by capturing future emissions and greenhouse gasses. Carbon stored in coniferous forests has been estimated to account for a third of terrestrial carbon (Kashian et al. 2006). These environments are dynamic and constantly changing and consequently the ability for them to sequester carbon varies as the stand develops.

Chapter 21: Northwest (Mote et al 2014) of Climate Change Impacts in the United States (Melillo Et Al. 2014) predicts an increase in annual temperature of 3.3°F to 9.7°F by 2070 to 2099 with the largest increase in the summer months. They also predict an 11-12% decrease in annual precipitation for 2030 to 2059. These predictions have potential impacts to water resources such as changes in the timing of streamflows related to snowmelt and potential reductions in the total supply of water and competing demands. Increase in summer temperature and potential changes in water availability is predicted to impacts forest environments through increased wildfire (frequency, duration and intensity), insect and disease outbreaks. It could also lead to long-term forest type transformations as suitable growing conditions change.

Regulatory Framework

The Forest Service does not currently have a national policy or guidance for managing carbon, and the tools for estimating carbon and sequestration are not fully developed. Current direction for addressing climate change issues in project planning and the NEPA process is provided in the document *Climate Change Considerations in Project Level NEPA Analysis* (USDA FS 2009). This document outlines the basic considerations for assessing climate change in relation to project-level planning.

- **Effect of the project on climate change**
  This specifically considers effects to greenhouse gas emissions and carbon cycling. This may include pyrogenic emissions associated with prescribed burning, changes in biogenic emissions through thinning and forest management, avoidance of large pyrogenic emissions

associated with wildfire through forest management, and carbon cycle alterations though reforestation and forest management.

- **Effect of climate change on the project**
  This includes effects of climate change on the seed stock selection for reforestation, potential changes in natural forest regeneration, and effects of decreased snow fall on recreation or stream flows.

Forest Service Strategic Framework for Responding to Climate Change

The USDA Forest Service mission is to sustain the health, diversity and productivity of National Forests and Grasslands to meet the needs of present and future generations. The agency has developed a strategic framework for Responding to Climate Change (USDA FS 2008) because climate change threatens the ability of the Forest Service to fulfill that mission. The framework describes interrelated programs of the agency to help forests, grasslands, and humans mitigate and adapt to global climate change.

Table XX: Seven goals from *Strategic Framework for Responding to Climate Change* (USFS 2008).

Foundational	**Science**	Advance our understanding of the environmental, economic, and social implications of climate change and related adaptation and mitigation activities on forests and grasslands.
	Education	Advance awareness and understanding regarding the principles and methods for sustaining forests and grasslands, and sustainable resource consumption, in a changing climate.
Structural	**Alliances**	Establish, enhance, and retain strong alliances and partnerships with federal agencies, State and local governments, Tribes, private landowners, non-governmental organizations, and international partners, to provide sustainable forests and grasslands for present and future generations.
	Policy	Integrate climate change, as appropriate, into Forest Service policies, program guidance, and communications and put in place effective mechanisms to coordinate across and within Deputy Areas.
Action	**Sustainable Operations**	Reduce the environmental footprint of Forest Service operations and be a leading example of a green organization.
	Adaptation	Enhance the capacity of forests and grasslands to adapt to environmental stresses of climate change and maintain ecosystem services.
	Mitigation	Promote the management of forests and grasslands to reduce the buildup of greenhouse gases, while sustaining the multiple benefits and services of these ecosystems.

Climate Change Research

The National Climate Change Assessment (Melillo Et Al. 2014) assessed the science of climate change and predicts potential impacts across the United States. Mote et al. (2014) predict some of the potential water challenges for the Pacific Northwest. They note that since 1950 the area-averaged snowpack for the Cascade Range decreased about 20% and spring snowmelt occurred 0-30 days earlier depending on location. They also describe studies showing late winter/early

spring streamflows increased from 0-20% and summer flow decreased 0-15% as annual flow. They also note that hydrologic response to climate change will depend on factors such as the dominant form of precipitation in a watershed, elevation, aspect, geology, vegetation and land use.

Evergreen coniferous forests dominate the Pacific Northwest and potential changes in precipitation and temperature are expected to affect these environments. Climate change is expected to alter Pacific Northwest coniferous forests through increasing wildfire risk and insect or disease outbreaks in the near future. Long-term changes could include shifts in forest types and species as environmental conditions change. Much of the potential changes are associated with changes in water availability which can result in drought stressed trees that are less resilient to disturbance agents.

Wildfire activity is expected to increase in duration and frequency as changes in water availability are likely to result in an earlier onset for wildfire activity and the end of fire season depends on season ending precipitation events. Mote et al. (2014) predicts that the median annual area burned in the Pacific Northwest will quadruple by 2080 with a 50% probability that 2.2 million acres would burn in a year. Predictions about fire activity are very general since the potential for any given acre to burn is dependent on a number of factors that vary across the Pacific Northwest.

Insect activity predictions focus on the mountain pine beetle and their impact to drier coniferous forests. Mountain pine beetle activity is increase pine mortality in the Pacific Northwest and the trend is expected to continue. Mountain pine beetle are often limited by elevation and associated temperatures. By the end of the century the upper limit of beetle activity is expected to increase with predicted temperature increases (Mote et al. 2014). The potential interactions between climate change and beetle activity are uncertain as beetle occurrence changes there are expected landscape changes that may affect the availability of host trees and ultimately the beetle.

Existing Conditions

The Melvin Butte Vegetation Management is within the Dry Coniferous Forest biome in Peterson et al (2014). Vegetation in this zone is characterized by ponderosa pine (*Pinus ponderosa*) or Douglas-fir (*Pseudotsuga menziesii*) as dominant species, but can have a significant percentage of true firs and lesser amounts of other conifer species. Typical weather patterns are warm, dry summers with hot daytime temperatures and cool nighttime temperatures. Winters tend to be cold and moist. Most of the annual precipitation is in the form of snow and during spring rainstorms. Rainfall amounts across the zone are highly variable but typically range between 35 cm/year to over 100 cm/year. Snowpack duration varies across this zone and ranges from 1 to 5 months. Snowpack is essential to capturing winter precipitation and converting that to available soil moisture during spring snowmelt.

The combination of cold winters and warm, dry summers results in vegetation that has the highest periods of growth in the spring and early summer when soil moistures are higher and temperatures are lower (Peterson et al. 2014). Limited soil moisture in this vegetation zone creates competition among plant species and can have large impacts on stand development.

Wildfires are a common disturbance agent in central Oregon with substantial activity on the Sisters Ranger District. Over 40% of the Sisters Ranger District has experienced wildfire over the past 12 years. Many of these fires tend to be low or mixed severity, but can be high severity patches. The Melvin Butte Vegetation Management project area is adjacent to the Pole Creek Fire of 2012 and has similar stand characteristics as areas affected by that wildfire. It is reasonable to assume that the project area could display similar fire behavior under environmental conditions experienced during the Pole Creek fire.

Stine et al. (2014) summarized potential changes to the moist mixed conifer forests of eastern Oregon and Washington under a scenario of increased temperature and decreased snowpack. This could include changes to growing season length and timing, timing of bud break (phenology), and seasonal soil moisture availability. Changes on a local scale could be variable as topographic features, such as drainages, can have substantially different environmental conditions than adjacent areas.

Alternative 1 (No Action)

The effect of the proposed project on climate change
Under this alternative stands will continue to develop and stocking levels will increase. Carbon will continue to be sequestered in currently accessible reservoirs but the rate of sequestration is expected to decrease as stands become overstocked to a point where growth becomes severely restricted from competition. This will lead to stands susceptible to insect and disease outbreaks associated with drought stress that will further reduce the stands ability for carbon fixation.

The effect of climate change on the proposed project
Predicted changes to precipitation and temperature are expected to affect the dry coniferous biome. Potential increased duration and intensity of summer drying can affect disturbance regimes in the biome. A reduced snowpack is expected to melt earlier and with increases spring and summer temperatures this could result in early drought conditions. Changes to snowpack and summer precipitation will likely result in reduced productivity for the dry coniferous forests at lower elevations.

Using predicted changes to precipitation and temperature combined with current stocking levels the project area would be at increased risk of wildfire. If a large fire occurs in the area the current stand conditions indicate a higher severity fire under similar environmental conditions to the Pole Creek Fire. Any large fire in the area would release a substantial amount of greenhouse gas. While predicting wildfire contributions to greenhouse gas is highly uncertain as the emissions depend on the specific environmental variables when the fire occurs recent fire history on the Sisters Ranger District indicates a potentially substantial amount of greenhouse gas emissions. The fuels report for this project calculated the potential emissions for a wildfire as 469,035 tons of CO_2 (MK –need to confirm w/ JR report)

Alternatives 2 and 3
Direct and Indirect Effects

Since the action alternatives are similar with respect to potential effects associated with climate change they will be analyzed together.

The effect of the proposed project on climate change
Over the short-term (less than five years) implementation of the proposed project on climate change would remove above ground live woody biomass that currently acts as a carbon reservoir. Seventeen percent (17%) of the project area is retained as no treatment area in Alterative 2 and 18% will be retained in Alternative 3. The no treatment areas of the project will be retained and continue to act as a carbon reservoir.
Prescribed burning could potentially occur across the project area and the carbon released by these activities is difficult to calculate as the amount of burning that can occur in any year is dependent on getting suitable weather. The fuels report calculates prescribed burning as releasing 200,323 tons of CO_2. This is based on every potential action burn happening which may not occur since burning depends on getting the appropriate weather conditions. It is also important that the potential release would occur over many years rather than a predicted large pulse associated with a wildfire.

Several treatments (especially plantation treatments) are expected to release currently suppressed trees so they can accelerate growth and continue capturing carbon over the long-term. Any areas that do not meet minimum stocking standards post-harvest will be replanted and these stands will continue to capture carbon as the seedlings grow.

Removal of above ground woody biomass would be a direct reduction in the ability of forests in the project area to perform carbon sequestration over the short-term. However, over the long-term the forest will regenerate and stands treated to improve tree health will allow currently overstocked stand to maximize growth and capture carbon. Stands without treatment identified will continue to have the highest potential for carbon storage as the soils identified in these stands has favorable properties to develop multi-story complex stands.

The effect of climate change on the proposed project
Potential effects of climate change on the proposed project are difficult to predict. As stated above, the expected changes in temperature and precipitation are expected to affect the drier coniferous forest biome. Stands that are categorized as moist mixed conifer may continue to be exposed to impacts from climate change as the current temperature and precipitation regimes that support them change. Soil moisture availability will continue to result in competition for resources and some stands.

Summary

The Pacific Northwest is predicted to have increases in annual temperatures and changes in water availability associated with climate change. Alternative 1 would allow the project area to continue carbon fixation but would likely place the area at increased risk of wildfire, insects or

disease. Alternatives 2 and 3 would remove above ground carbon stores but would reduce the potential for a large pulse input of CO_2.